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(54) Control system of the consumptions of a household appliance

(57) A control system of the consumptions of a household appliance, comprising an electronic microcontroller (LC) and non-volatile memory means (M) associated with said microcontroller (LC), said apparatus being connected during use with at least one source of an external resource (water, electric energy, gas, etc.), said external resource being required by the apparatus for carrying out an operating cycle, where said apparatus also comprises setting means for the manual selection of one or more operating parameters and signaling means (1).

According to the invention, within said memory means (M) coded information are contained, which are used by the control system (LC) in function of at least one selection actuated through said setting means, for calculating the consumption of the external resource required by the household appliance to execute an operating cycle, said signaling means (1) being capable, if required, to show the consumption level of the external resource.

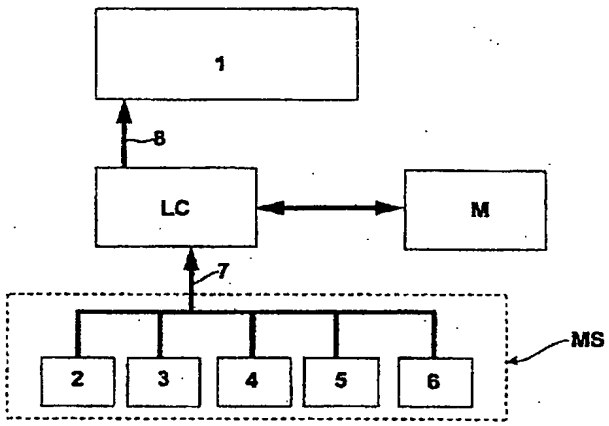

FIG. 1

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Description

The present invention relates to a control system of the consumptions of a household appliance, such as a washing machine.

It is known that through an improper use of a household appliance a waste of energy will ensue in the majority of cases.

In the specific case of a washing machine, for instance, it happens quite frequently that following an improper usage of the appliance, wastage does not only involve electric energy, but also water and detergent. Quite often, in fact, the user introduces an excessive quantity of detergent to warrant washing and cleaning performance of the laundry. This not only increases the quantity of polluting residues released to the environment, but will also require an increased quantity of water to rinse the clothes adequately. Similar problems may also occur for dishwashers, while an incorrect control setting in the use of refrigerators and baking ovens will as well lead to an energy wastage.

In the specific case of a washing machine it also happens that for the washing of resistant clothes (e.g. white cottons) some users tend to use wash cycles at high temperature (typically 90°C), having acquired such a habit in the past when detergent powders still contained bleaches (phosphate based oxidants, no longer admitted by law due to their highly polluting effect) that were activated only under high temperature conditions. However, since detergents are now phosphate free as they contain other bleach types performing at lower temperatures (typically 60°C) and are also rich of enzymes (biologic elements that become active at 30-60°C), washing can take place at 60°C to obtain satisfactory cleanliness.

Therefore, heating water up to 90°C instead of 60°C will obviously require a higher energy consumption.

Moreover, washing machines are now featured by a preset number of wash programs and options (temperature setting, spin speed setting, reduced laundry load, etc.) differing from one model to another and tending to increase the machine cost proportionally. The various programs are associated with different types of fabrics, while the options allow the user to customize the selected wash-cycle. Therefore, the situation can be summarized as follow:

- energy consumption mainly depends on the type of laundry, its quantity, the temperature value of the washing water, the type of program selected by the user and likely availability of hot water in the mains;
- water consumption depends upon the type of laundry, its quantity and the number of rinses associated with the program selected by the user;
- detergent aid consumption is essentially dictated by the user (habits, culture, experience, etc.).

Household appliances usually known do not give direct indications to the user about consumption of external resources (electric energy, water, detergent aid, gas, etc.) associated with a specific program selected and likely options. The only information related to consumptions associated with different situations (type of program and type of clothes for washing machines, etc. ...) are included in the instructions for use delivered with the appliance; however, these do not always contain exhaustive data.

Only with reference to detergent aids consumption, some types of washing-machine, by supplying to the user the information concerning water hardness, allow for a more correct metering of detergents according to their instructions on the package.

It is the object of the present invention to solve the above problems and provide a household appliance fitted with a proper control system capable of solving any wastage problem of 'primary' or external resources, (energy, water, gas, etc.), making the user 'aware' of the consumptions associated with his selections, through adequate 'feedback' instruments or 'dialog' means during the interaction of the user with the appliance (i.e. type of program, options, etc.).

To reach such a purpose it is the object of the present invention to provide a control system for the consumption of a household appliance incorporating the characteristics of the annexed claims, which are integral part of the present description.

Further purposes, features and advantages of the present invention will be apparent from the following detailed description and annexed drawings, which are supplied by way of an explanatory not limiting example only, wherein:

- Fig. 1 shows schematically a part of the control system of a household appliance according to the invention;
- Fig. 2 shows schematically an element of the control system represented in Fig. 1 during a first operating condition;
- Fig. 3 shows schematically an element of the control system represented in Fig. 1 during a second operating condition;
- Fig. 4 shows schematically an element of the control system represented in Fig. 1 during a third operating condition;
- Fig. 5 shows schematically an element of the control system represented in Fig. 1 during a fourth operating condition.

In FIG. 1 a part of a control system of a household appliance is schematically shown, provided according to the characteristics of the present invention. In such an example, the appliance is a washing machine, not shown as a whole for simplicity's sake.

In FIG. 1, reference number 1 indicates a display unit as a whole and MS a plurality of sensor means,

which are provided in the washing machine and allow measurement of various quantities related to its operation.

To this purpose, number 2 indicates a temperature sensor, for example a thermoresistive element of the NTC type, for the temperature measurement of the washing liquid; number 3 indicates a pressure switch that, in addition to its standard function as a water level sensor, operates along with an electronic control system of the washing machine as a sensor means of the quantity of laundry, of the quantity of water used for washing and eventually of the type of fabric.

As to the operating procedure of a common first-level electromechanical pressure switch combined with an electronic control system to identify the three quantities above (fabric type, quantity of laundry and quantity of water) reference could be made for instance to the European Patent Application EP-A-0 649 932.

However, it should be noticed that said three quantities can also be detected through different individual sensor means, in themselves known.

Number 4 indicates a sensor to detect the quantity of detergent used, whose operation may be based for instance on measuring the resistivity of the washing water. To this purpose reference could be made to the European Patent Application EP-A-0 582 329, describing a device capable of measuring the water resistivity and obtain a number of informative data from such a measurement, being useful for the control of the operation of a washing machine, such as for instance ionic concentration of detergent in water, water hardness degree, kind of soil associated with the laundry, and so on.

Number 5 indicates a measuring device of the electric energy absorbed by the machine during operation. Such an energy measuring device can be obtained exploiting for instance the capacities offered by the electronic control system of the appliance according to the invention. Within this frame, according to a preferred embodiment of the invention, such an energy measuring device can be obtained through the same electronic control system of the appliance, adequately programmed for calculating with a good approximation the individual consumptions of its electric components.

As mentioned above, in fact, the control system of the appliance according to the invention, is of the electronic type, based on the use of a microcontroller having suitable non-volatile memory means; according to a significant feature of the invention, said memory means contain coded information related to the typical consumptions of the various electric/electronic components of the appliance (such as pumps, solenoid valves, motors, heaters, pilot lights, etc.), according to their different conditions of use.

Said information are the result of practical investigations and tests and form a 'knowledge base' having the purpose of allowing the identification of the consumptions, per time unit, of said electric/electronic components of the appliance.

Therefore, assuming that in an electronic control system as described above:

- the various operating programs which can be executed by the appliance are coded within the non-volatile memory means associated to the microcontroller,
- said operating programs essentially consist of actuating controls, for determined sequences and determined times, of said electric/electronic devices,
- it is the microcontroller that, on the basis of said programs, manages the operation of said electric/electronic devices
- any microcontroller is equipped with an internal clock (CLOCK),

according to the invention, coded instructions and data tables (knowledge base) are stored within the permanent memory means associated to the microcontroller, for calculating the total energy consumption realized during an operating program executed by the appliance; such a total value is obtained by summing the various individual consumptions, i.e. the electric energy consumptions of each electric/electronic component, which the control system is able to calculate on the basis of the available instructions and data, as explained above.

According to the invention, the result of said calculation of the total energy consumption of the appliance can be efficiently used for several purposes, such as to be displayed for the users 'awareness' of energy saving, or be stored within adequate memory means for statistical purposes and always with a view of simplifying the appliance programming work for the user, as it will be better explained in the following.

Back to FIG. 1, number 6 indicates a device for measuring the rotation speed of a basket or drum of the laundry washing machine, e.g. a speedometer dynamo.

Sensors MS send their respective signals through proper connections 7 to the microcontroller system indicated with LC, associated with the above mentioned memory means indicated with M. The control system LC, through a connection 8, is able to pilot display 1, consisting for example of a liquid crystal (or a LED panel or still a fluorescent panel, etc.).

The display 1 comprises various indicator means, which can be seen in details in FIG. 2, namely:

- a temperature indicator T,
- an indicator Q of the type of laundry, i.e. of the type of fabric being washed,
- an indicator P of the quantity of laundry,
- an indicator D of the quantity of detergent,
- an indicator DT of the type of detergent,
- an indicator W of electric energy consumption,
- an indicator L of water consumption,

- an indicator C of maximum spinning speed,
- an indicator S of the progress status of the washing cycle,
- an indicator B of the 'door locked' condition (as required by safety standards),
- an indicator A of the 'creasefree' option (cycle stop at the end of the last rinse, with the clothes soaked in water),
- a numerical indicator SC, suitable for displaying various information suggested by the control system LC, such as water hardness of the mains or residual time to end a washing cycle in course.

Said indicators are, in the given example, of the bar and index type, with the exception of the indicator SC, which consists of four 7-segments 'digits', of the indicator DT consisting of two luminescent segments (one for liquid detergent and the other for powder detergent) and of the indicators A and B, consisting of symbols that may be illuminated as required.

The control panel of the washing machine, not shown, is equipped with proper manual setting means, for the selection of the desired functions.

Such setting means may consist of classic knobs, keys, sliders, etc., which allow for the setting of various options related to a washing cycle, such as the selection of the type of washing, the spin speed, the washing temperature, and of special functions to be associated with a washing cycle (for instance the above 'creasefree' option).

In a preferred embodiment of the invention, the washing machine is equipped with a programming system of the type described in the European Patent Application EP-A-0 725 181.

Said document describes an electronic control system for a washing machine capable of controlling the execution of a complete washing cycle as a function of one parameter alone set by the user, said parameter being related to the most delicate fabric to be washed In the practice, such a microcontroller control system is provided with an adequate 'knowledge base' coded according to the Fuzzy Logic rules, allowing the selection of the best operating parameters of the machine (i.e. the above mentioned 'actuating controls') as a function of just one 'qualitative' selection set by the user, to obtain a satisfactory washing.

However, to comply with his personal requirements, the user is able to change some operating parameters within given 'safety' limits, imposed by the control system itself, such as washing temperature or spin speed.

In the following description, let it then be assumed that the control system and control means of the laundry washing machine described with reference to this invention are of the type disclosed in EP-A-0 725 181.

To this purpose, the laundry washing machine has therefore a selector for the type of clothes to be washed, which is used to set the washing cycle, and other additional selecting means, which allows optional changes to the optimized operating parameters, consisting of keys to select the washing temperature and the spin speed, and keys for the control of special functions (e.g. a 'creasefree' key).

As already highlighted, the laundry washing machine is equipped with an electronic control system based on a microcontroller, advantageously programmed according to the Fuzzy Logic rules; to this purpose, the permanent memory means associated with the microcontroller contain adequate information, that the control system uses for fulfilling its functions. In the case of the present invention, such information comprise at least:

- programs which allows the control system to obtain useful information from the sensors MS and manage the various electric/electronic components of the machine, accordingly with such information;
- adequate knowledge base, consisting of experimental data, i.e. information obtained through proper practical tests.

A first part of said knowledge base consists of coded data which, as said, are used by the machine control system to calculate with good approximation through sensors 3, 4 and 5, the actual water, electric energy and detergent consumption at the end of a washing cycle.

A second part of such knowledge base refers to the optimized operating parameters of the machine, depending upon the different conditions of use; said parameters allow the control system to suggest an optimized washing cycle to the user, in function of the selection of the same user (type of fabric and, eventually the temperature, the spin speed, etc.).

According to the invention, a third part of the knowledge base refers to coded data used by the control system to indicate an estimated electric energy and water consumption to the user, as well as the optimized quantity of detergent that the user should introduce in the machine for the execution of the optimized washing cycle suggested by the control system.

The operation of the appliance according to the invention will now be described with reference to FIGS. 2-4 which represent the display 1 during several operating steps of the laundry washing machine.

FIG. 2 shows the situation when starting a washing cycle, i.e. directly after the user switches on the machine through an ON/OFF key, not shown. As it can be seen, the indicator S of the progress state of the washing cycle is on its initial position.

After introducing the clothes to be washed into the drum, the user selects the type of laundry to be washed through the above mentioned selector. The control system reacts to such a selection by displaying the type of fabric on indicator Q, through a proper index QI. In the specific case shown in FIG. 2, it is assumed that the user wishes to wash synthetic clothes.

On the basis of the information stored within the memory means, and in function of the selection made by the user, the control system gives the user himself a number of 'suggestions', which correspond to the optimized parameters for said washing cycle. To this purpose, the control system duly control the various indicators of the display 1.

Therefore, an optimized quantity of laundry (3 kg in the given example) appears on the indicator P, through an illuminated index PS, i.e. the quantity suggested by the control system LC in relation to the type of laundry selected by the user (synthetic fabrics), so as to reach a right compromise between best washing performance and the maximum saving. As it can be imagined, the control system LC will research said information about the optimized quantity of laundry within its own memory M.

The control system LC gives useful advices also with respect to the use of detergent.

Specifically, the luminescent segment corresponding to the type of suggested detergent (liquid detergent in the given example) will light up on indicator DT; a luminescent index DS on indicator D shows on the other hand the quantity of (liquid) detergent suggested to the user for carrying out the cycle previously selected (a quantity of 100 grams is indicated in the given example).

Always as a function of the cycle selected by the user, the control system LC estimates both the energy and the water consumption to carry out an optimized washing, (i.e. that suggested for synthetic clothes, of 3 kg of laundry and with 100 g. of liquid detergent). The control logic LC researches, within its own memory M, said consumption information, which is estimated as a function of the type of fabric indicated by the user.

The estimation of total electric energy consumption is indicated on the energy absorption indicator W through a luminescent index WS (in the given example a consumption of 0,7 kWh is assumed); the estimation of total water consumption is instead indicated on the water consumption indicator L through a luminescent index LS (in the example a consumption of 40 liters of water is assumed).

In the example shown here, the maximum spin speed and the temperature as suggested for the washing are not yet shown by their relevant indicators C and T; said data will be shown after the user has pressed a wash start push-button, not shown here. Anyway, it should be noticed that in a further embodiment of the invention also these two data could be 'suggested' before starting the washing cycle.

During that phase, the numerical indicator SC can be used by the control system to indicate the level of the water hardness; obviously this information, which is obtained by the control system through the above mentioned water resistivity sensor is a historical data (i.e. detected, stored and eventually updated in time following the washing cycles previously carried out by the machine).

FIG. 3 represents the situation which directly follows actuating the control to start washing, i.e. pressing the cycle start push-button.

As said, in the example, a laundry consisting of synthetic clothes has been selected by the user through the relevant selector; this choice is made final right when the user presses down said push-button: as a result, any further actuation of the selector concerning the type of laundry will be subsequently ignored by control system LC.

At this time, the temperature indicator T will show an optimized washing temperature, suggested by control system LC through a luminescent index TS; this is also displayed in a numerical/figures way for a few seconds on the numerical indicator SC (in the specific case 40°C). If desired, the user may change said temperature through the setting means previously mentioned. The temperature changes done by the user are immediately shown on the temperature indicator T, by an index TU (which can be seen in FIG. 4) and on the numerical indicator SC in a numerical form.

Let us now assume that the user changes the temperature for instance to 50°C.

During the water heating, the height of a luminescent bar TR on the temperature indicator T will show the current temperature detected by the relevant temperature sensor 2 (FIG. 1).

The indicator C displays the maximum spin speed through a luminescent index CS; also in this case the user can change said suggested value, through the relevant setting means provided to this purpose. While the user is changing the maximum spin speed, the numerical indicator SC may show the number of revs/min.; at any rate, the speed changes made by the user are also immediately shown on the speed indicator C (relocation of the luminescent index CS).

Always with reference to FIG. 3, the remaining indicators will stay in their start positions, specifically:

- the indicator S of the state of progress of the washing cycle is still in its initial position;
- the quantity of laundry (3 kg) suggested by the control system LC, in relation with the type of laundry selected by the user (synthetic fabrics), remains indicated by the luminescent index PS on the indicator P;
- the type (liquid) and the quantity (100 grams) of the suggested detergent remain indicated on their relevant indicators DT and D, respectively through the luminescent segment associated with the liquid detergent and the index DS;
- the estimated energy consumption (0,7 kWh) remains shown by the luminescent index WS on the indicator W;
- the estimated water consumption (40 liters) remains indicated by the luminescent index LS on the indicator L.

The situation represented in FIG. 4 occurs a certain time after the start of the washing, which is 1 hour and 25 minutes in the specific case. As it can be seen, this time is highlighted on the numerical indicator SC.

The figure also shows how the indicator T retains the temperature data originally suggested by the control system through the index TS, and eventually the temperature data changed by the user through the index TU. On the other hand, the height of the illuminated bar TR indicates the temperature detected right then by the relevant temperature sensor 2 (current value of water temperature in the washing tub).

The quantity of laundry (3 kg) suggested by the control system LC in relation to the type of laundry selected by the user (synthetic fabrics) remains indicated by the luminescent index PS on the indicator P, whereas the height of an illuminated bar PR on the same indicator indicates the actual quantity of clothes loaded by the user, as detected by the control system through the analysis of the pressure switch operation 3 (in accordance with the matter described in the previously mentioned EP-A-0 649 932).

The type (liquid) and the quantity (100 grams) of detergent originally suggested by the control system remain indicated on the relevant indicators DT and D; whereas the height of an illuminated bar DR indicates the quantity of detergent detected by the control system LC, up to that moment. Therefore, this is a temporary value that will become final only at the end of the washing.

The originally estimated energy consumption (0.7 kWh) remains indicated by the index WS on the indicator W; the height of an illuminated bar WR indicates instead the actual consumption of electric energy up to that moment; also in this case, this is a temporary value that will become final only at the end of the washing.

The water consumption originally estimated (40 liters) remain indicated with a luminescent index LS on the indicator L, whereas the height of a little bar LR indicated the actual water consumption up to that moment; also in this case we are facing a provisional value that will become final only at wash end.

The indicator S of the state of progress of the washing cycle is now in line with the final part of the rinsing stage, which is reached within 1 hour-25 minutes from the cycle start.

Indicator C finally displays the maximum spin speed (e.g. a mean value) that may be eventually changed by the user through proper means (e.g. a knob or a couple of push-buttons for increasing or decreasing said speed till spinning is concluded).

The situation represented in FIG. 5 occurs after the washing cycle is over. To this purpose, the numerical indicator SC displays the word 'END' and the indicator S of the state of progress of the washing cycle has reached its final position.

The indicator T retains the temperature data originally suggested by the control system through the luminescent index TS, and eventually the temperature data changed by the user through the index TU, whereas the height of the illuminated bar TR indicates the temperature detected right at that moment by the relevant temperature sensor 2.

The quantity of laundry (3 kg) suggested by control system LC with reference to the type of clothes selected by the user (synthetic fabrics) remains indicated by the luminescent index PS, whereas the height of the illuminated bar PR indicates the actual quantity of clothes detected by the control system.

The type (liquid) and the quantity (100 grams) of detergent originally suggested by the control system remain indicated on the relevant indicators DT and D, respectively through the luminescent segment of the fluid detergent and the index DS; whereas the height of an illuminated bar DR indicates the actual total quantity of detergent detected by the control system LC.

As it can be imagined, the difference between the suggested value (DS) and the detected value (DR) represents a measurement criteria for the correct metering of the detergent by the user. The lesser the difference, the more correct the metered quantity will be.

The energy consumption (0.7 kWh) originally estimated remains indicated by the index WS on the indicator W; whereas the height of an illuminated bar WR indicates the actual consumption of electric energy. In the example, energy consumption is higher than estimated at the start by the control logic (LC), probably because the user has set a higher temperature (50°C) than the one suggested by the control system (40°C).

Water consumption (40 liters) originally estimated remains indicated by the luminescent index LS on the indicator L, whereas the height of an illuminated bar LR indicates actual water consumption. Also in this case a higher water consumption than that foreseen can be noticed, due to the fact that the user has loaded a higher quantity of clothes and introduced a higher quantity of detergent aid than suggested (see indicators P and D).

Finally, the indicator C will show the maximum spin speed used during the washing cycle just completed.

As it can be seen from the example above, upon termination of the washing cycle, both the indications of actual energy, water and detergent consumption determined by the user's actuations, and the values estimated by the control system at the start of the washing remain on the display, in relation with an optimized cycle 'suggested' by the control system itself.

Thus, according to the invention, the users have comparing data available and the opportunity of expressing a judgment about their own choices (for instance 'I determined a too high water consumption because the quantity of detergent I used was too high', or 'I determined a too high energy consumption because temperature I selected was too high', or 'I determined a water saving because I used liquid detergent', etc.).

Therefore, according to the present invention, it is

proved how the control system of a household appliance can supply the user, under a suitable graphic and/or numerical form, by mean of a suitable display, two different types of information concerning energy, water and detergent consumption as follows:

- 'preliminary' information, consisting of an estimation, when each washing cycle is selected (i.e. before starting the actual washing), of the energy and water consumption being associated with the choices made from time to time by the user (program type and likely options) and with the average quantity of laundry estimated by the control system, on the basis of the data coded within its memory means. The information concerning the detergent relate on the contrary to both the detergent type (liquid or powder) and the quantity; the detergent type is suggested according to the fabric characteristics (information supplied by the user: type of clothes), whereas the estimated quantity is meant as an optimized quantity, suggested by the control system to minimize the water consumption and the negative impact on the environment;
- 'final' information, indicating the actual energy and water consumption at the end of the washing. As regards the detergent, the quantity detected is correlated with the quantity which the control system considered the optimal one, thus giving the user a comparison term to improve the metering of the detergent.

It should be noticed that, in view of the user's awareness, the control system can be easily programmed to update the 'preliminary' information on the display 1 nearly in real time, in function of the selections actuated by the user on the provided selector means.

Therefore, as it can be imagined, the 'preliminary' information play a significant 'educational' role for the user, as they report nearly instantaneously the effect of the user 's choices (program type and likely other options) on the consumption of a resource supplied from an external source, such as water or electric energy.

Through the 'feedback' realized by said information, which the control system LC supplies to the user on the display 1, the latter will be able to look for the conditions of a minimum global consumption that can be associated with the laundry requirements (selection of a right consumption/performance compromise); to this purpose, the information concerning the quantity of detergent are also very useful for any user to acquire - washing after washing - the capability of metering correct quantities.

If said information are supplied under graphic form, as for the example in the annexed figures, it may be though of the use of a bar or index consumption display (energy, water, detergent and quantity of clothes); in this case the dialog with the user becomes very simple as it is of a qualitative type: each action by the user (program selection or option addition) corresponds to a simultaneous change of the consumption indexes, which represents the effect said action.

The characteristics of the present invention as well as its advantages are clear from the given description.

It is obvious that many changes are possible for the man skilled in the art, to the electronic control system described by way of example, without departing from the novelty spirit of the innovative solution.

For instance, the idea of using for a household appliance informative data capable of helping the user to reduce consumptions to improve the environment protection can be extended to products other than laundry washing machines; the invention can in fact also find application on dishwashers, electric or gas baking ovens and cookers, household heating boilers and in general on any household appliances absorbing a 'primary' resource, such as electric energy, water, gas, etc., whose consumptions may be in some ways affected by the user's behavior.

In the embodiment described above by way of example, the washing temperature values TS and the maximum spin speed values VS are highlighted only after the washing cycle has been started by pressing a specific key. However, it is evident that such 'preliminary' information can be made available to the user before starting the washing cycle itself i.e. as represented in the situation of FIG. 2.

It was also mentioned above that the control system of the appliance according to the invention is capable of acquiring and storing automatically proper information related to previous washing cycles; therefore, the 'final' information can be used by the control system for updating statistical data retained by the control system itself, within a relevant non-volatile memory, to express the user's 'habits' with time.

Among said statistical data, the average quantity of laundry usually loaded by the user in the machine (also related to the different types of fabrics) can be specifically of interest.

Thus, the control system will be able to release 'preliminary' information on the display 1, based on the user's habits in relation with the average quantity of laundry being washed. In other words, when starting a washing cycle, the user who usually washes 3.5 Kg of synthetic clothes will see highlighted on display 1 the optimized or suggested temperature, quantity of detergent, spin speed, water and energy consumption values estimated in relation to the washing of 3,5 Kg synthetic clothes.

A further embodiment may concern the programming system, which can be of the type requiring a plurality of information from the user to the control system. According to this variant embodiment, the user has to set at least a couple of parameters (for instance the type and the quantity of clothes) and an optimized configuration of the operating parameters in the control system

memory will correspond to the couple of values set by the user.

It should also be noticed that the optimized configuration of the operating parameters of the appliance, corresponding to the choices actuated by the user (for instance the type of clothes in conjunction with weight) and the relevant consumption forecast, may be calculated on the basis of mathematical and physical models stored in the memory means of the control system, instead of being recalled as pre-calculated elements pertaining to a knowledge base (in accordance with the control techniques based on the Fuzzy Logic).

It is clear, anyway, that many other changes to the household appliance described above by way of example are possible for the man skilled in the art, without departing from the novelty spirit of the innovative solution, and it is also clear that in the practical actuation of the invention the components may differ in form and size from the ones described and be replaced with technical equivalent elements.

Claims

1. Control system of the consumptions of a household appliance, comprising an electronic microcontroller (LC) and non-volatile memory means (M) associated to said microcontroller (LC), said household appliance being connected during use with at least one source of an external resource (water, electric energy, gas, etc.), said external resource being necessary to the apparatus for carrying out an operating cycle, the household appliance also comprising setting means for the manual selection of one or more operating parameters and signaling means (1), characterized in that within said memory means (M) information are coded which the control system (LC), in function of at least a selection operated through said setting means, uses to calculate the consumption of the external resource being required by the household appliances to execute an operating cycle, said signaling means (1) being suitable, if necessary, to show the level of consumption of the external resource.

2. Control system, according to claim 1, characterized in that said information comprise first coded data used by the control system (LC) to estimate the consumption of the external resource required by the household appliance to execute an operating cycle, before that said operating cycle is terminated.

3. Control system, according to claim 1, characterized in that said information comprise second coded data used by the control system (LC) to calculate, through suitable sensor means (3,4,5), the actual consumption of the external resource by the household appliance during the execution of an operating cycle or at the end of the same.

4. Control system, according to claim 2, characterized in that said signaling means (1) comprise first indicating means (W,L) for showing the estimated level (WS,LS) of the consumption of the external resource.

5. Control system, according to claim 3, characterized in that said signaling means (1) comprise second indicating means (W,L) for showing the actual level (WR,LR) of the consumption of the external resource.

6. Control system, according to claims 4 and 5, characterized in that said first and second indicating means (W,L) coincide and are in particular suitable to show the difference between the estimated level (WS,LS) of consumption and the actual level (WR, LR) of consumption of the external resource.

7. Control system, according to one or more or the previous claims, characterized in that said external resource is electric energy and/or water and that said signaling means (1) comprise an electric energy absorption indicator (W) and/or a water consumption indicator (L), respectively.

8. Control system, according to claim 1, characterized in that said information comprise third coded data used by the control system (LC) to preset the apparatus for executing an operating cycle being considered as optimized, in function of at least one selection actuated through said setting means.

9. Control system, according to claim 8, characterized in that said household appliance is a washing machine and that said third data comprise the suggested quantity (DS) and/or type (DT) of detergent to be used for the execution of said operating cycle considered as optimized.

10. Control system, according to claim 8, characterized in that said household appliance is a laundry washing machine and that said third data comprise a suggested quantity of laundry (PS) and/or a maximum spin speed (CS) to be used for the execution of said operating cycle considered as optimized.

11. Control system, according to claim 8, characterized in that said third data comprise a suggested temperature level (TS), which should be set through said selection means for the execution of said operating cycle considered as optimized.

12. Control system, according to claim 8, characterized in that said signaling means (1) comprise third indicator means (P,T,C) for showing the level of one or

more parameters (PS,TS,CS) relating to said operating cycle considered as optimized.

13. Control system, according to claim 8, characterized in that one or more parameters (TS,CS) relating to said operating cycle considered as optimized can be changed, for the execution of a preferred operating cycle, and that said signaling means (1) comprise fourth indicator means (T) for showing the modified parameters (TU) and their actual level (TR) during said preferred operating cycle or at the end of the same.

14. Control system, according to claims 12 e 13, characterized in that said third and fourth indicator means (P,T,C) coincide and are in particular able to show the likely difference between the level of the parameters (PS,TS,CS) relating to said operating cycle considered as optimized and the actual level (PR,TR) of the parameters relating to said preferred operating cycle.

15. Control system, according to claims 2 or 8, characterized in that said first data and/or third data are correlated to the user's habits (average quantity of washed laundry).

16. Control system, according to claims 3 or 7, characterized in that the sensor means used to calculate the actual consumption of electric energy are comprised in said control system (LC) and that said information comprise fourth data used by the control system (LC) to calculate the consumption of electric energy realized during an operating cycle executed by the household appliance, the consumption value being specifically obtained summing up the consumptions of a plurality of electric and/or electronic components of the household appliance, which are activated during said operating cycle.

17. Control system, according to claim 4, characterized in that the control system (LC) is programmed for updating on said first indicator means (W,L) the estimation level (WS,LS) of the consumption of the external resource, in function of the choices actuated by the user on the selector means, so as to show, in particular instantaneously, the effects that the user's actuations have on the external resources consumption.

18. Household appliance, comprising an electronic control system according to claim 1, characterized in that means are provided (1) to signal

- preliminary information, relating to an estimation of the consumption of an external resource, such as electric energy, water, gas, associated with the selections made from time to time by the user, and
- final information relating to the actual consumption of the external resource.

19. Control method of the consumptions of a household appliance of the type comprising a control system with an electronic microcontroller (LC), said household appliance being connected during use with at least a source of an external resource (water, electric energy, gas, etc.), necessary for the execution of an operating cycle of the household appliance, said household appliance also comprising setting means for the manual selection of one or more operating parameters and signaling means (1), characterized in that, in function of the setting of at least one operating parameter of the appliance done by an user, the control system (LC) controls said signaling means (1) for showing a level of consumption of the external resource required by the household appliance to execute an operating cycle, in particular with the purpose of instructing the user on the correct setting of the operating parameters to minimize the consumption of the external resource.

20. Control method, according to claim 19, characterized in that, in function of the setting of said parameter, the control system (LC) controls said signaling means (1) with the purpose of showing an estimated consumption level of the external resource.

21. Control method, according to Claim 19, characterized in that, in function of the setting of at least one operating parameter of the household appliance done by an user, the control system (LC) controls said signaling means (1) with the purpose of showing an optimized configuration of several operating parameters of the household appliance, said optimized configurations being specifically supplied to the user for minimizing the consumption of the external resource.

22. Control method, according to claim 19, characterized in that during an operating cycle and/or at the end of the same, the control system (LC) controls said signaling means (1) with the purpose of showing the actual consumption of the external resource used by the household appliance to execute said operating cycle.

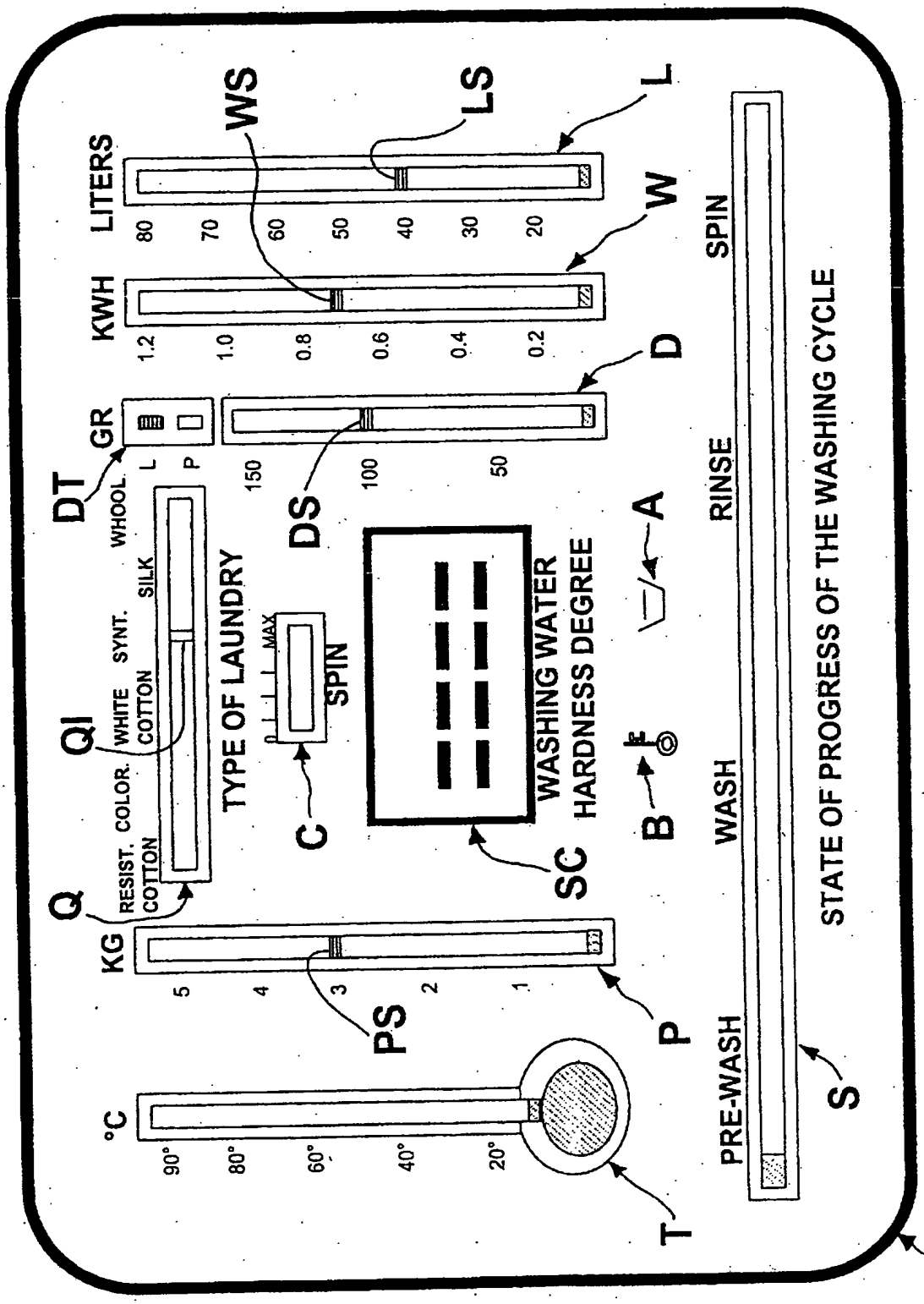
23. Control method, according to claims 20 and 22, characterized in that the control system (LC) controls said signaling means (1) with the purpose of showing any difference between the estimated consumption level and the actual consumption level.

24. Control method, according to at least one of the

previous claims, characterized in that a signaling of preliminary information, relating to estimated consumptions of the external resource is provided, such as electric energy, water, gas, associated with the selections made from time to time by the user, and of final information, relating to the actual consumptions of the external resource.

25. Control method, according to at least one of the previous claims, characterized in that the control system (LC) acquires, stores and eventually updates information being representative of the user's habits in relation with at least one of said parameters and that said control system (LC) controls said signaling means (1) for showing an optimized configuration of other operating parameters, or an estimated consumption level of the external resource, in relation with said information being representative of the user's habits.

26. Control method of the electric energy consumption of a household appliance of the type comprising a control system with an electronic microcontroller (LC), characterized in that it allows for the estimation of the presumed total consumption of electric energy that will be reached during an operating cycle of the apparatus, the total consumption value being obtained by the calculation of the presumed partial consumptions of electric energy realized by each individual electric and/ or electronic component of the household appliance, said presumed partial consumptions being obtained by multiplying the electric energy absorbed by each component for the time it will be activated during the operating cycle selected by the user, said presumed total consumption of electric energy being obtained by summing up said presumed partial consumptions.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D
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DS
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SILK
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WHITE
COTTON
QI
TYPE OF LAUNDRY
MAX
SPIN
C
WASHING WATER
HARDNESS DEGREE
A
B
SC
RESIST. COLOR.
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°C
90°
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T
PRE-WASH
WASH
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S
STATE OF PROGRESS OF THE WASHING CYCLE
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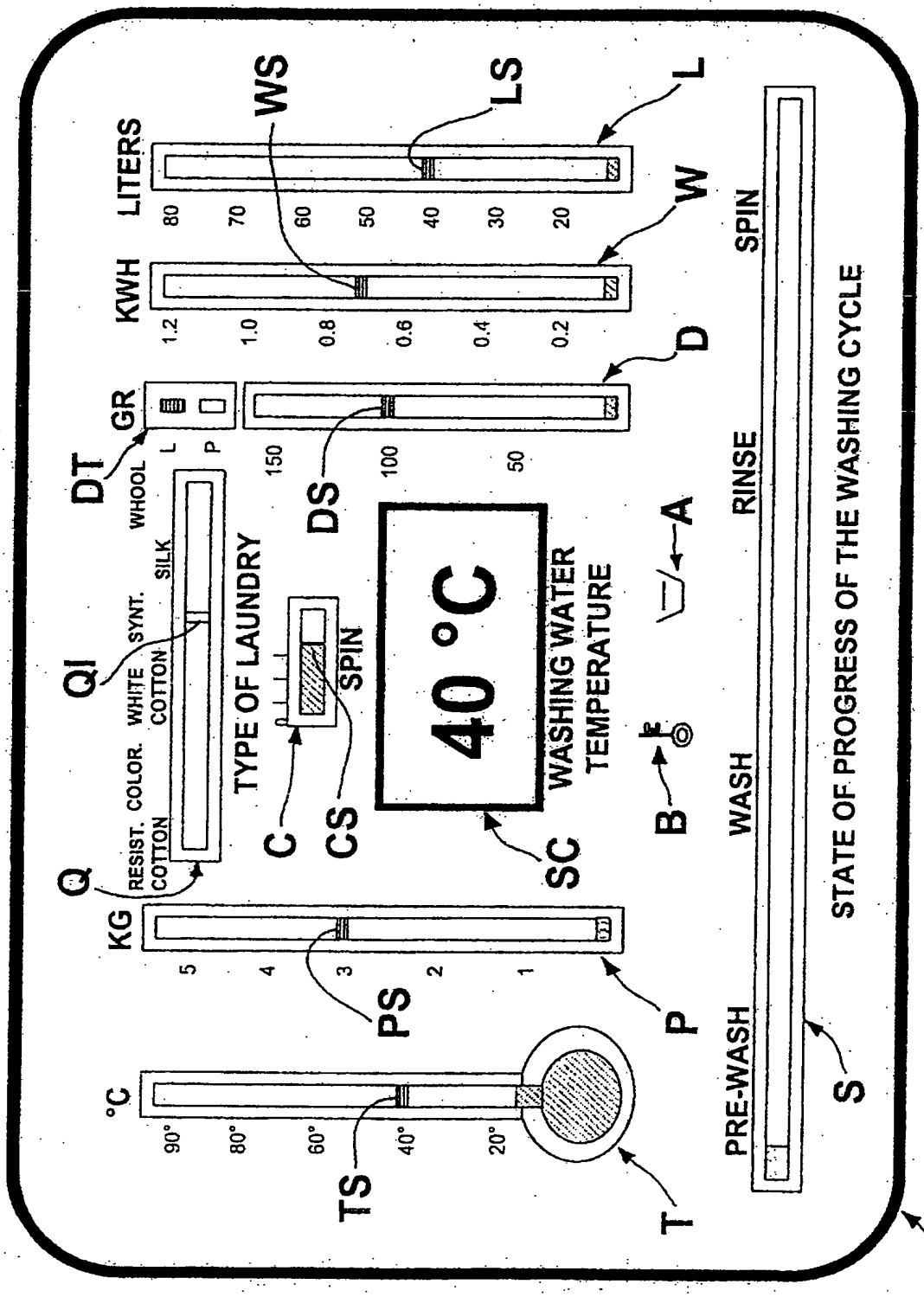
FIG. 2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WASHING WATER
TEMPERATURE
SC
A
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PRE-WASH
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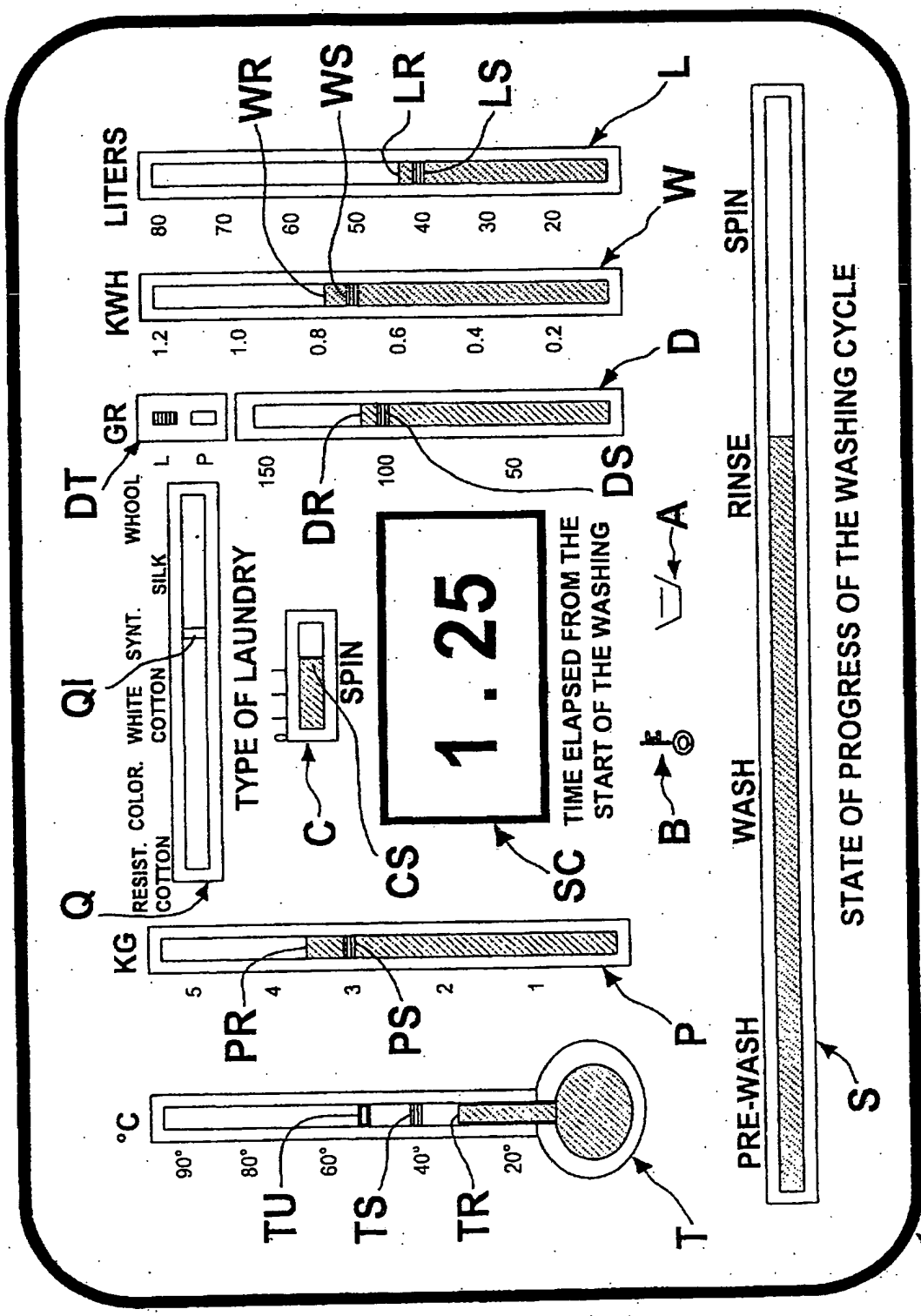
1

FIG. 3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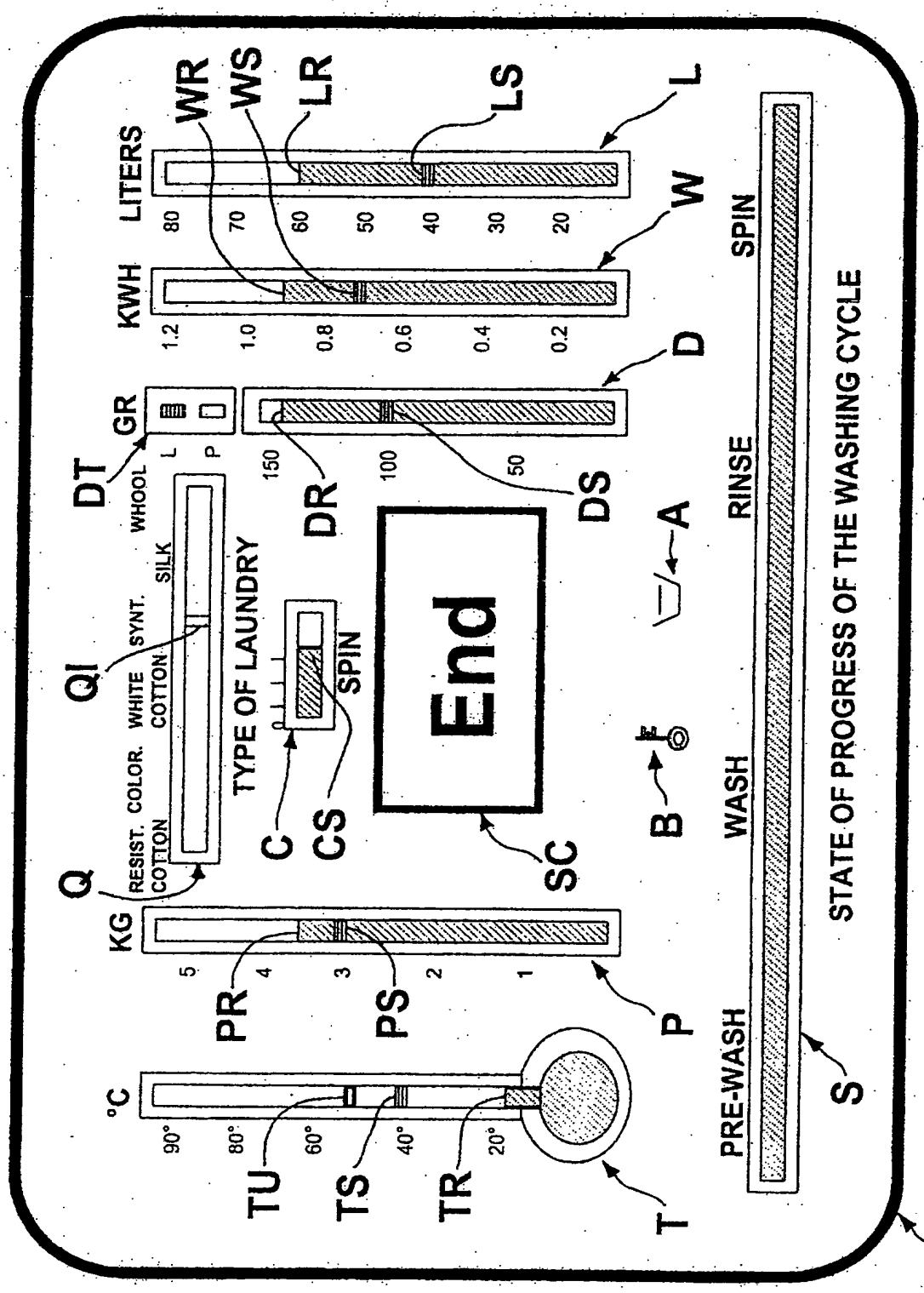
LITERS
KWH
WHOOL
SILK
SYNT.
WHITE COTTON
COLOR.
RESIST. COTTON
TYPE OF LAUNDRY
SPIN
1 . 25
TIME ELAPSED FROM THE START OF THE WASHING
PRE-WASH
WASH
RINSE
SPIN
STATE OF PROGRESS OF THE WASHING CYCLE

FIG. 4


STATE OF PROGRESS OF THE WASHING CYCLE
PRE-WASH
WASH
RINSE
SPIN
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L
W
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A
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P
T
SC
End
C
CS
SPIN
TYPE OF LAUNDRY
RESIST. COTTON
COLOR. COTTON
WHITE COTTON
SYNT.
SILK
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QI
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WS
LR
LS
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DS
1

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 12 0629

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 39 32 170 A (LICENTIA PATENT-VERWALTUNGS-GMBH)	1-5,7, 16-22, 24,26	D06F39/00
A	* the whole document *	6,8,15, 23,25	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D06F
A47L
F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 March 1998	Courrier, G

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